

ENGINEERING EDUCATION FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS BY 2030: REVEALING THE PATHS FOR CHALLENGING CLIMATE CHANGE AND COVID 19

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ABSTRACT: This is a review article on problems and solutions relating to Education for Sustainable Development (ESD) in Engineering education. The review policy for this study was to use documents published by the United Nations (UN), research and working papers published in refereed journals and reports on ESD for Sustainable Development Goals (SDGs). About 75% papers of this review were published between 2010-2017; 20% between 2017-2020 and rest 5% at the end of the last century. This review focused on ESD for engineering education climate change, environment, pollution and COVID 19 issues in relation to SDG-3 (Good health and well-being), SDG-4 (Quality education), SDG-6 (Clean water and sanitation) SDG-7 (Affordable and clean energy), SDG-9 (Industry, innovation, and infrastructure), SDG-11 (Sustainable cities and communities), SDG-12 (Ensure sustainable consumption and production pattern), SDG-13 (Climate action) and SDG-17 (Partnerships for the goals). The research revealed that major engineering schools of all discipline are using ESD as an add-in strategy in curriculum due to various constraints. The main barriers to implementing ESD for engineering are: the lack of policy of the countries, shortage of experienced academic staff, trade-offs policy between current curriculum and ESD; lack of partnership among university, society and industry. The findings would have some implications for global institutions involved in policy issues related to SDGs and ESD. The findings would be also useful for the countries and universities that meet annually to review progress on developing curriculum for engineering education towards Agenda 2030. However, this is a fundament work which bring the insight of trade-offs between current curriculum for ESD in engineering education in that aspect, the work is novel.

Keywords: Engineering education, Sustainable development, Quality education, Clean water, Renewable energy, Climate change, COVID-19, Engineering

1.0 INSIGHT OF ENGINEERING EDUCATION AND CHALLENGES TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS

The Agenda 2030 encompasses sustainable development goals (SDGs) which seeks to strengthen the social, economic and environmental dimensions of development. The Implementation of the Agenda 2030 requires science and logic based on holistic, coherent and integrated approach at the global, regional, national, social and individual levels; as well as inter-linkages within and between the relevant stakeholders [1]. As per the expert review commissioned by the UNESCO (2005a), the key objective of the ESD is to give a deep understanding to the students on complex environmental, economic, and social systems for achieving SDGs by 2030[2].

Currently, the world is suffering from unsustainable development due to higher levels of pollution in the air (due to carbon emission), water (due to toxic effluent) and soil (due to industrial and agriculture solid wastes) [3]. Likewise, the major climate fossil fuel at power plants, industrial wastewater treatment plants, decomposing industrial and agriculture waste biomass. In this regard, Shahidul et al. (2020) stated that the main sources of increasing global warming, climate change and biodiversity loss are the industrial pollutions, carbon emission, and industrial toxic effluent[4]. In all these activities indeed, engineers are significantly involved with other professionals. However, a common social idea has prevailed that the professionals involved in the industrial production process may not be fully competent to reduce the pollution level to the acceptable limit; and may be due to that reason, the environmental quality is declining towards a devastated level [3].

However, during the Earth Summit 1992 and UNESCO meeting held in 2005, four areas were highlighted as the fundamental tools for achieving global sustainable development goals. The areas are the Quality of basic education; Education programs toward sustainable development; Public awareness and Understanding of sustainable development; and training promotion on sustainable development [5] [2][6].

Indeed, it is evident that industrial pollution is significantly responsible for the current poor-quality environment, climate change, and biodiversity loss. It was also found that engineering activities are involved in all these industrial processes. These phenomena have inspired us to consider the ESD for engineering education [4] [7]. The relationship of SDGs and engineering activities for sustainable development could be elucidated in Figure 1

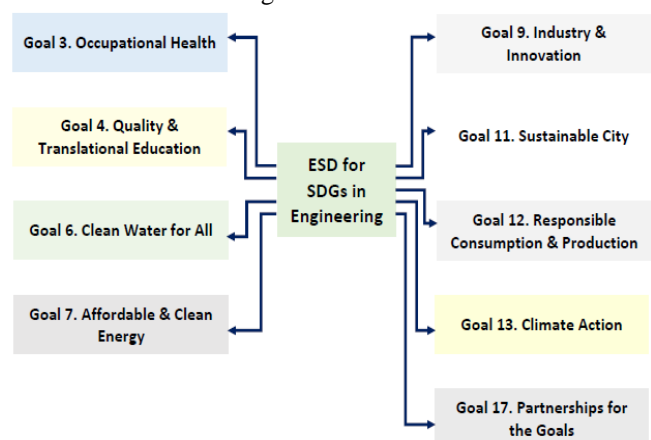


Figure 1: ESD in SDGs for Engineering Education [7, 2]